



# OMPS SDR OVERVIEW

NOAA STAR  
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# Cal/Val Team Members

PI	Organization	Team Members	Roles and Responsibilities
Trevor Beck, Chunhui Pan	NOAA, UMD- CICS	Eve-Marie Devaliere, Xiaozhen Xiong, Ding Liang-ICVS	Coordination; instrument and product performance monitoring.
Glen Jaross	NASA	Tom Kelly, Rama. Mundakkara, Mike Haken, Colin Seftor	Instrument scientist; TVAC data acquisition and analysis; SDR algorithms
Laura Dunlap	STC/AMP		Algorithm Changes; DR and issues tracking
Sarah Lipsy	BATC		Instrument Scientist; prelaunch test
Daniel Cumpton	Raytheon	Derek Stuhmer	IDPS Operations

- Configuration
  - Two grating Spectrometers:
    - NM 300-380nm, 420nm
    - NP 250-310nm
  - Actively cooled CCD detectors
    - 780x364 pixels OMPS-TC
    - 390x364 pixels OMPS-NP
- Onboard Calibration
  - LED provides non-linearity calibration
  - Reference Solar Diffuser and working Solar diffuser together provide method to track degradation.
  - Orbital Dark current measurements.
- SDR Products
  - Nadir Mapper has Global coverage every 24 hours. 2800km swath
  - Nadir Profiler has 250km swath, Viewing angle  $\pm 8^\circ$
  - Biweekly solar measurements for Nadir Mapper and Profiler.
- Sensor Differences S-NPP and NOAA-20
  - N20 has increased downlink bandwidth and FSW data compression.
  - N20 OMPS-TC capable of 10Km<sup>2</sup> ground pixel size
  - N20 OMPS-NP measurements have 25 times the number of ground pixels.
  - N20 has improved Solar diffuser material

Limb Profiler not present on NOAA-20, returns on JPSS-2.

# Algorithm Overview

- CCD detector measurements are spatially binned according to a sample table in the flight software(FSW).
- Binning reduces the required bandwidth and increases the SNR.
- The FSW does co-adding and applies gain and non-linearity corrections.
- For NOAA-20 the measurement counts are compressed.
- The ground processor corrects for dark current, smear, and straylight.
- Wavelength registration is corrected
  - OMPS-NP has seasonal temperature variation, biweekly updates.
  - OMPS-NM has orbital temperature variations
- S-NPP SDR reached Validated Maturity in September 2015
- NOAA-20 reached provisional Maturity July, 2018

# OMPS-NM Product Overview

Product	L1RDS APU Thresholds	S-NPP Performance	N-20 Performance
Non-linearity Accuracy	<0.2%	<0.2%	<0.2%
SNR	1000	>1000	>1000@50km <sup>2</sup>
Straylight Out-of-band & Out-of-Field response	<2%	<2%	Analysis Pending New Tables
Orbital thermal wavelength shift	0.02nm	~0.006nm	~0.01nm
Absolute irradiance cal accuracy	<7%	<7% for most channels	<7%
Absolute radiance Cal accuracy	<8%	<8%	<8%
Albedo calibration accuracy	<2%	<2% For most channels	~2%

# OMPS-NP Product Overview

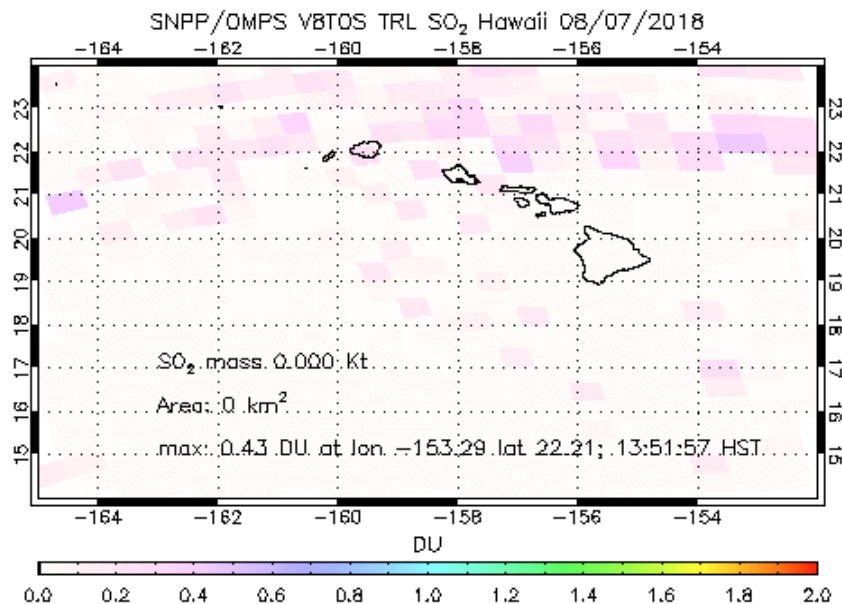
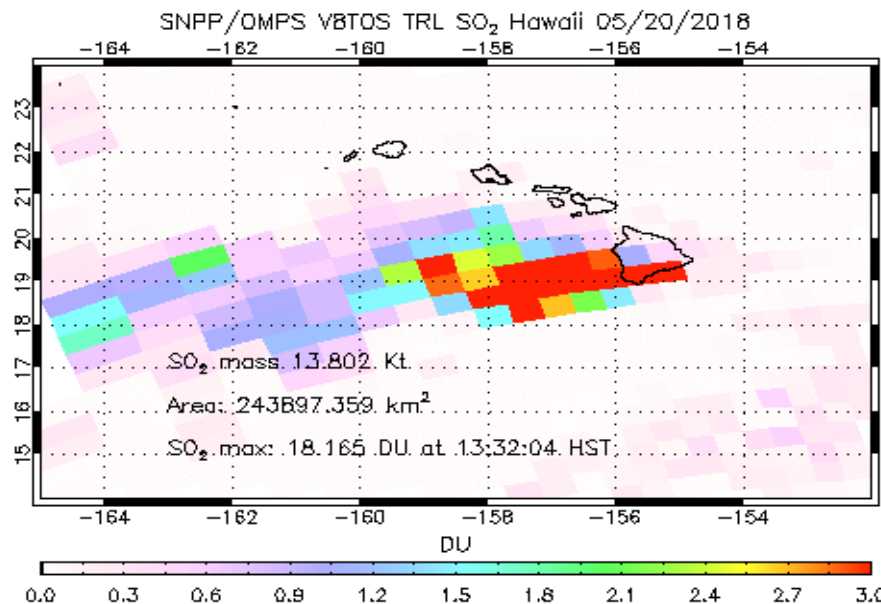
Product	L1RDS APU Thresholds	S-NPP Performance	N-20 Performance
Non-linearity Accuracy	<0.2%	<0.2%	>.2% in some channels
SNR	45-400 channel dependent	>1000	Meets Spec
Straylight Out-of-band & Out-of-Field response	<2%	<2%	>2%, but Analysis Pending New tables
Orbital thermal wavelength shift	0.02nm	~0.006nm	>.02nm, intra-orbit
Absolute irradiance cal accuracy	<7%	<7% for most channels	<7% for most channels
Absolute radiance Cal accuracy	<8%	<8%	<8%
Albedo calibration accuracy	<2%	<2% For most channels	Analysis Pending

# OMPS EDR Products

There are three EDR algorithms for JPSS-1 OMPS in NDE

- SO<sub>2</sub>, Linear Fit SO<sub>2</sub> method( LFSO<sub>2</sub>)
- Total Ozone, using the version 8 algorithm
- Ozone profile, using the version 8 algorithm.

Below: Estimated SO<sub>2</sub> over active Kilauea, HI on a very active day and the more recent quiet day. Courtesy of Jianguo Niu, OMPS EDR team.





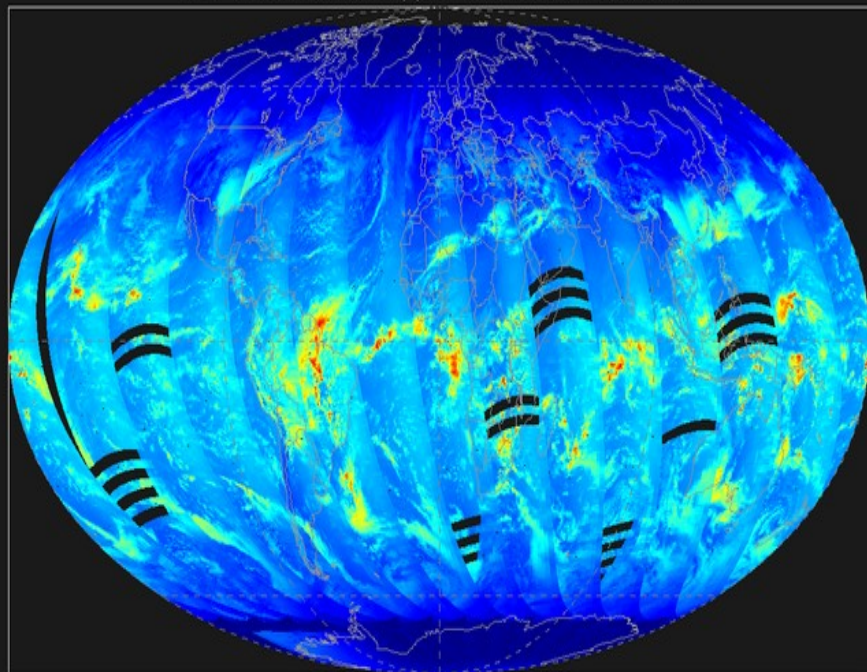
# NOAA-20 Major Issues and Mitigation

Risk/Issue	Description	Impact	Action/Mitigation
DR_8616 N20	16 Scan RDR, unexpected variance in CCSDS packet times. Result of Data Compression in NOAA-20.	Up to 20 Missing Granules per day	Fixed in MX03 IDPS Build
DR_8594 N20	OMPS Provisional Tables, poorly chosen at-launch sample tables	Striping in lowRes mode	OMPS-TC switched to MedRes Mode in Feb. 8, 2018. IDPS SDR is 50km cross and 17km along Ground pixels size at nadir.
DR_8617 N20	The Field of View for OMPS-TC and OMPS-NP large difference spatially in scene.	Ozone Profile retrieval, EDR errors.	New flight tables tested. Special collections. Set of twelve IDPS tables being delivered.
DR_8730 N20	Unexpected Outliers / Discretization error in Non-Linearity correction for OMPS-NP	Non-linearity requirement not met	Flight table and ground tables need to be delivered: OMPS-NP-CALCONST_j01 and OMPS-NP-NONLINEARITY-LUT

# Data Quality Issues, Missing Granules from IDPS

- The 16 scan RDR problem. The unexpected variance in packet times used in Ingest to create the RDR caused a missing granule problem. This is ongoing in IDPS until Sept. 24, the MX03 TTO.

N2O OMPS Nodir Mapper Radiance at 318.0nm

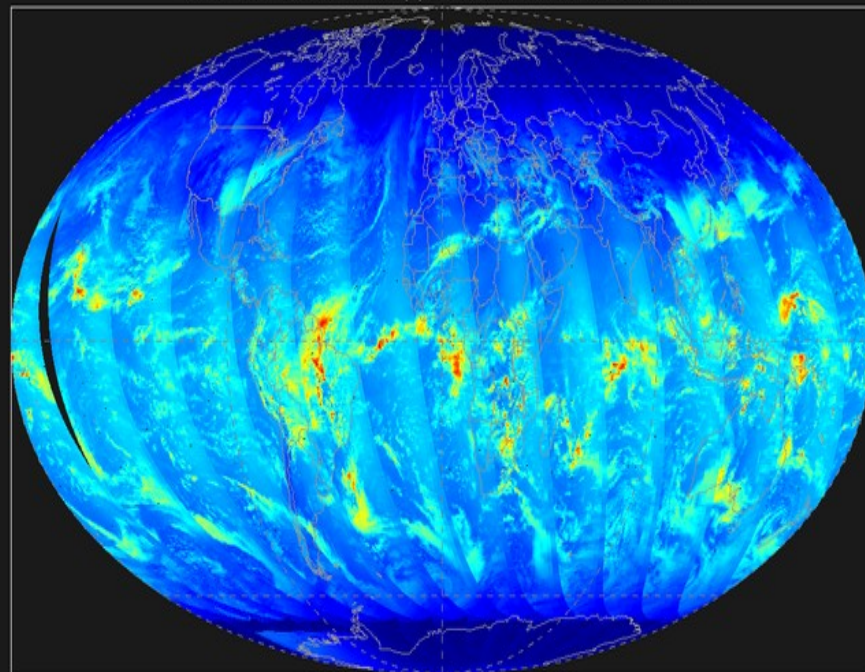


N2O OMPS Watts/cm²/nm/Sr 2018/02/21 at 318.0nm



before\_xGran\_2018-02-21.png

N2O OMPS Nodir Mapper Radiance at 318.0nm

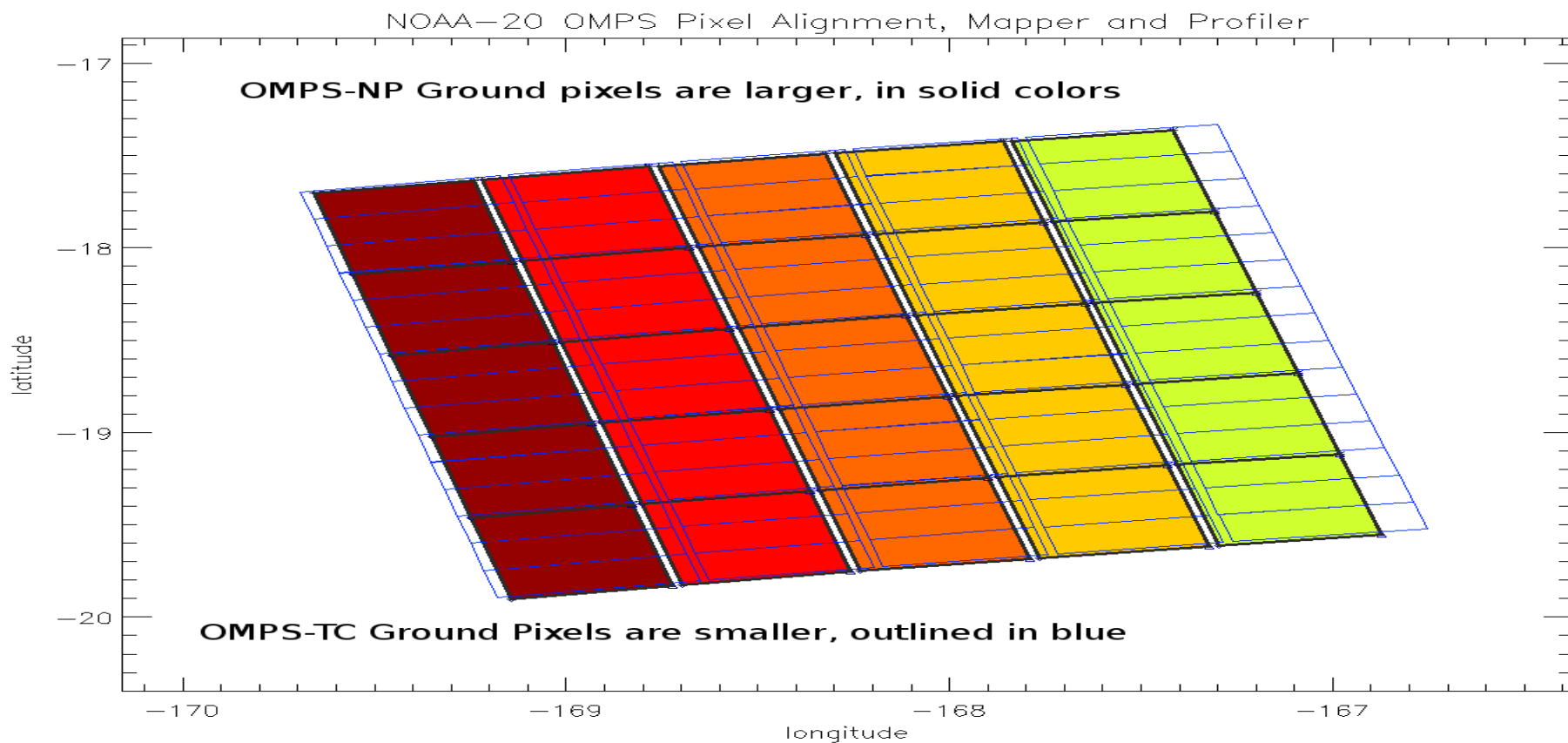


N2O OMPS Watts/cm²/nm/Sr 2018/02/21 at 318.0nm



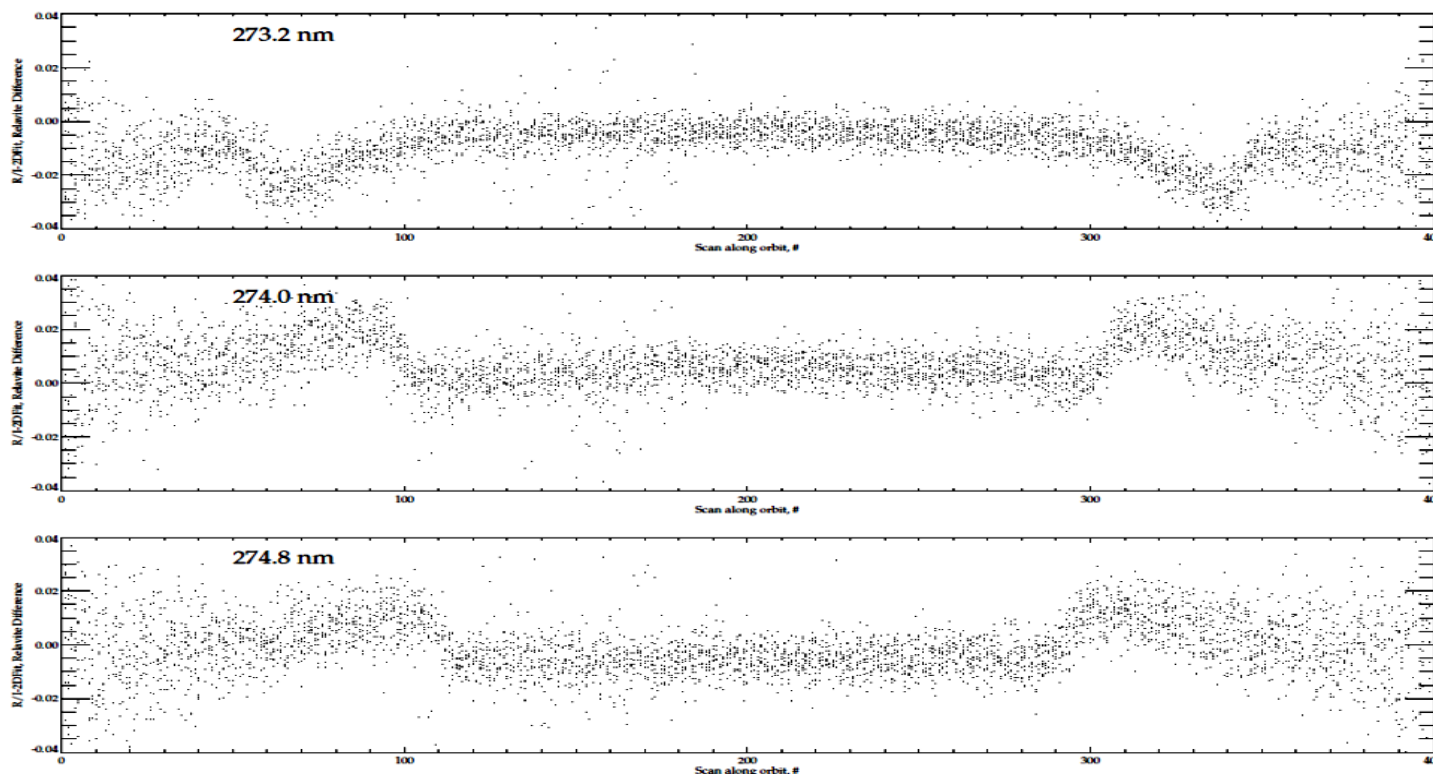
with\_xGran\_DR\_8616\_2018\_02\_21.png

- The Field of View for OMPS-TC and OMPS-NP difference is large. In the EDR ozone profile retrieval the radiances from both the OMPS-NP and OMPS-TC Nadir are combined to form one scene with spectral sampling from 252nm to 380nm. If the fields of view are not aligned between the two sensors this will cause significant retrieval errors over inhomogeneous scenes.



# Remaining Challenge, Non-Linearity correction

- Non-Linearity problems were discovered in NOAA-20 OMPS-NP. The OMPS EDR team found up to 2% errors in some low signal channels. Not all channels are affected. The OMPS-NP non-linearity correction flight table will be changed in the near future. The image below shows signal level dependent errors as a function of along track for one orbit. The expected behavior is noise distributed about the zero line.



# FY19 Milestones and Deliverables

Task	Description	Deliverables	Scheduled Date
DR_8684,8685	OMPS SDR Quality Flag Implementation	Code Change	TTO Q2 2019
DR_8730	Non-Linearity table Update	Table Delivery	TTO Q1 2019
DR_8709	OMPS Smear Transient Detection and Correction	Code change	2019
	Validated Radiance Requirements		Q1 2019

# Future Plans/Improvements

- Algorithm Improvements
  - Smear Transient Detection and Correction
  - Bi-weekly solar flux and wavelength deliveries for N20-OMPS-NP.
  - Possibility to increase spatial resolution from current 17km by 50km to 17km by 17km.
  - OMPS-NP wavelength intra-orbital correction
- J2 OMPS and Beyond
  - J2 OMPS Nadir Instruments substantially similar to NOAA-20.
  - J2 Limb Instrument will return. J2 Limb SDR and EDR NOAA operational products will be made at NDE.
  - J2 Limb will measure radiance from 290nm to 1000nm.
  - J2 NOAA operational EDR will produce ozone profile with a vertical resolution of ~1.5km.



# OMPS Reprocessing

- Reprocessing was completed for January 2012 to March 2017.
- The S-NPP reprocessing will be redone. A new OMPS-TC straylight table went into operations July 8, 2018. The SDR data record needs to be reprocessed prior to the new straylight table change.
- The purpose of the reprocessing is to create a consistent SDR set using the best set of input LUTs and a consistent algorithm.
- The OMPS EDR team at NOAA has reprocessed the total ozone and ozone profile datasets and will repeat the EDR reprocessing once the most recent SDR reprocessed datasets are available.
- The NOAA-20 SDR reprocessing will begin in 2019.
- NOAA-20 SDR reprocessing will need to address several problems
  - Different sets of sample tables from Feb 8, 2018 to Oct. 2018.
  - Non-linearity correction coefficient changes in late 2018.

# Long Term Monitoring with ICVS

[http://www.star.nesdis.noaa.gov/icvs/status\\_NPP\\_OMPS\\_NM.php](http://www.star.nesdis.noaa.gov/icvs/status_NPP_OMPS_NM.php)

[http://www.star.nesdis.noaa.gov/icvs/status\\_NPP\\_OMPS\\_NP.php](http://www.star.nesdis.noaa.gov/icvs/status_NPP_OMPS_NP.php)

[http://www.star.nesdis.noaa.gov/icvs/status\\_NPP\\_OMPS\\_LP.php](http://www.star.nesdis.noaa.gov/icvs/status_NPP_OMPS_LP.php)

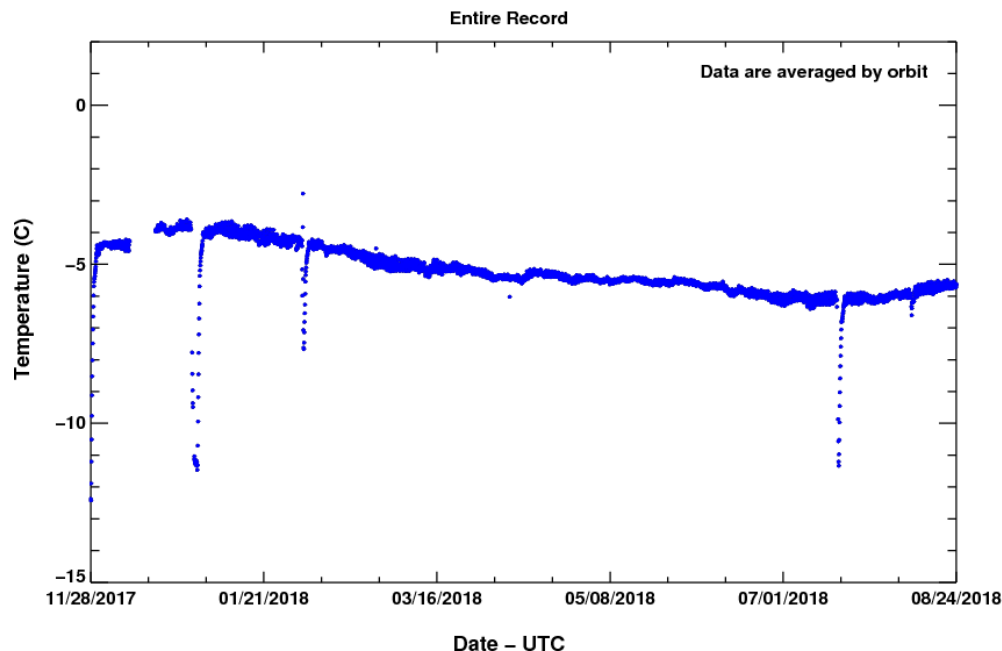
[http://www.star.nesdis.noaa.gov/icvs/status\\_J01\\_OMPS\\_NM.php](http://www.star.nesdis.noaa.gov/icvs/status_J01_OMPS_NM.php)

[http://www.star.nesdis.noaa.gov/icvs/status\\_J01\\_OMPS\\_NP.php](http://www.star.nesdis.noaa.gov/icvs/status_J01_OMPS_NP.php)

The NOAA/STAR ICVS provides long term monitoring of key parameters

- Instrument Health and
- Sensor Performance
- SDR Product Monitoring
- Data Quality Assessment
- Anomaly Detection
- Anomaly Notification

N20 OMPS Nadir System  
Temperature: Nadir Telescope  
Updated: 08/25/2018 – 13:08:59 UTC



**ICVS OMPS Monitoring  
Presentation on Wednesday by  
Ding Liang**



- NOAA-20 OMPS reached provisional Maturity in July, 2018. The team is working towards Validated Maturity.
- NOAA-20 OMPS had problems with the at-launch tables. There have been delays.
- NOAA-20 OMPS has advantages over S-NPP OMPS in spatial resolution.
- NOAA-21 OMPS will have the Limb and Nadir instruments.
- The SDR team work very closely with the OMPS EDR team, feedback has been positive.
- There will be an OMPS SDR session on Wednesday, August 29 at 1pm in Room 2554. More details will be presented by the SDR team.